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KARL SAX, 1892-1973

RICHARD A. HOWARD

*With portrait \**

KARL SAX, PROFESSOR OF BIOLOGY at Harvard and the third director of the Arnold Arboretum, was born in Spokane, Washington, November 2, 1892, and died in Media, Pennsylvania, October 8, 1973. His parents were William L. Sax, a school teacher, superintendent of County Schools, and one-time Mayor of Colville, Washington, and Minnie A. Morgan Sax, an artist and amateur botanist. After completing high school, Sax took a year of business training, then entered Washington State College and received a B.S. degree in agriculture in 1916. He came to the Bussey Institution of Harvard University, in Jamaica Plain, Massachusetts, and was awarded an M.S. degree in 1917; after which he served in the United States Army, at first as a private and later, from 1918 to 1919, as a second lieutenant at Fort Amador in the Canal Zone. His early professional employment was first as an instructor in genetics at the University of California at Berkeley, then as a plant breeder for the Riverbank Laboratory at Geneva, Illinois. Subsequently he joined the staff of the Agricultural Experiment Station, University of Maine, Orono, Maine, where he worked from 1920 until 1928, during which time he also earned a D.Sc. (1922) from the Bussey Institution. In 1928 Sax was appointed Associate Professor of Plant Cytology at the Arnold Arboretum, with a faculty appointment on the staff of the Bussey Institution as well. He was promoted to a full professorship in 1936, and during the reorganization of the Bussey Institution he moved his office, research laboratories, and students to the Biological Laboratories of Harvard University in Cambridge.

With the retirement of Dr. Elmer D. Merrill as director of the Arnold Arboretum, Sax was appointed acting director in 1946, and then director the following year. Sax's administrative role at the Arnold Arboretum was terminated in 1954, but he remained as Professor of Biology until 1959.

Sax had planned on his retirement to continue his work in plant breeding in the area of Media, Pennsylvania; yet for part of each year between 1959 and 1966 he accepted appointments as visiting professor at the Uni-

\* Portrait courtesy Harvard University News Office; taken in 1959.

versity of Florida, Yale University, North Carolina State College, the University of California, the University of Tennessee, Cornell University, and the University of Georgia, thus avoiding the cold and the dormant growing seasons of Pennsylvania. Also, at the age of sixty-nine, he received a Guggenheim Fellowship which he used at Oxford, England.

Sax was a national lecturer for the American Institute of Biological Sciences (1957) and for The Society of the Sigma Xi (1962), and he presented the Lowell Lectures in Boston in 1951 on the subject, "Population Problems of the World." He was elected to membership in the American Academy of Arts and Sciences and the National Academy of Sciences (1951); and he became an honorary member of Phi Beta Kappa (1941), an honorary member of the Japanese Genetics Society (1956), and a foreign correspondent of the French Academy of Agriculture (1946). In 1956 he received the Certificate of Merit from the Botanical Society of America. His horticultural work was recognized by the award of the Jackson Dawson Memorial Medal of the Massachusetts Horticultural Society in 1959 and the Norman J. Colman Award of the American Association of Nurserymen in 1961. He was named horticulturist of the year by the University of Massachusetts Student Horticultural Club (1959), and later the University of Massachusetts awarded him an honorary Doctor of Science degree (1965). His own college, Washington State University, named Sax a "distinguished alumnus" in 1966. He belonged to many professional societies and served as president of the Genetics Society of America (1958) and of the Planned Parenthood League (1958).

Sax's research and publications were primarily in three fields, cytology and genetics, horticulture, and demography, and in each he left his mark. His first scientific paper, in 1916, concerned fertilization in *Fritillaria*, and began a long study of the behavior of chromosomes in pollen and of fertilization and seed production. At that time the number of chromosomes in most taxa of flowering plants was unknown, and over a period of years he and his students contributed systematic studies of chromosome numbers in various families and genera. Many of these studies were based on the extensive collections at the Arnold Arboretum. His observations on the behavior of chromosomes led to extensive studies and initial contributions on chromosome structure and the mechanism of crossing over. Since much of his employment was with stations interested in agriculture, he worked on wheat, beans, corn, and apples as significant crop plants. Sax's most important early contribution was the demonstration and publication of the fact that allopolyploidy existed in the cultivated wheats, and that basic series of 7, 14, and 21 chromosome numbers existed. Although the fact was published a few months earlier by a Japanese botanist, Sax's work was independent, and he is usually credited with this contribution.

The failure of chromosomes to pair and resultant sterility are often associated with chromosome breakage. The methods of chromosome breakage were the object of Sax's research for many years, during which he used experimental exposures to X-rays and other types of radiation, as well as variations in temperature, age, and chemicals. His classic paper in 1938,

dealing with X-ray induced chromosomal aberrations in *Tradescantia*, opened up a new area of investigation subsequently exploited by others. Several grants from the National Institutes of Health, in his post-retirement period, supported his study of the radio-mimetic effects of common products such as coffee, cola beverages, drugs, and food additives.

Sax's contributions in the field of horticultural plant breeding produced many hybrid plants which he named. Perhaps the best known are a hybrid cherry, *Prunus* 'Hally Jolivette,' named for his wife, and *Magnolia* 'Dr. Merrill,' named for his predecessor as director of the Arnold Arboretum. His interest in improving *Forsythia* resulted in the tetraploid *Forsythia* 'Arnold Giant,' and *Forsythia* 'Karl Sax' (later named for him by Dr. Joab Thomas), which have proved better plants than the *Forsythia* 'Arnold Dwarf' or the problematic triploid *Forsythia* 'Beatrix Farrand.' Numerous crabapples, selected from deliberate crosses or open pollinations, include *Malus* 'Henrietta Crosby,' *M.* 'Beatrix Potter,' and *M.* 'Henry DuPont,' all named for Friends of the Arnold Arboretum, many of whom sponsored his research.

At the University of Maine, Sax began a study of apples that was continued throughout his life. It involved production, propagation, breeding, and selection, as well as methods for producing dwarf trees through the use of understocks, interstocks, and bark inversions. By inverting a ring of bark on apple trees, Sax was able to demonstrate a control of tree growth. Although the technique was known in nearly ancient horticultural literature, its modern application has been adopted, with Sax's techniques, by many nurserymen who now produce small trees for the home garden. Sax demonstrated the nutritional blocking effect of this bark inversion by the use of radioactive compounds in studies of phloem transport. Another of his inventive recommendations, the use of weed killers and insecticides in a grease base for the control of poison ivy and bark borers, was much used before environmental concerns restricted the general use of such chemicals.

While at the Bussey Institution, and later in the Biological Laboratories in Cambridge, Sax was in close association with the distinguished geneticist, Edward M. East, who was concerned with the expanding world population and the problems of feeding an ever-increasing number of people. After East's death, Sax developed his own interest in demographic problems and was a spokesman for the Planned Parenthood program. His book, *Standing Room Only*, recently reprinted as a paperback, and his many lectures, newspaper reports and special articles on the subject of birth control brought criticism from the Catholic community of Boston. In fact, for a period he was subjected to embarrassing harassment for his views.

His tenacity in his beliefs also showed up in his opposition to a proposal by botanists at Harvard that the resources of the Arnold Arboretum be used for the general benefit of botany as a whole. A University committee had recommended that portions of the collections of books and specimens of the Arnold Arboretum be moved to Cambridge, closer to the students, and be combined with other comparable collections maintained by Harvard.

The funds of the Arboretum were to be used within the Department of Biology, and the interest in horticulture and the living collections was to be lessened. Sax did not approve of this plan; he opposed it in principle and then in implementation. As the director he would not carry out the proposal until it was submitted to judicial review and approved legally. Therefore, the Harvard Corporation relieved him of his responsibilities as director of the Arnold Arboretum and supervisor of the Bussey Institution. As Professor of Biology, however, he continued his teaching and research until he reached the normal retirement age of 66. Sax contributed a great deal of information to the group which fought this move through the courts of Massachusetts in a suit against the Harvard Corporation. He was a worthy opponent. An associate, Mrs. Beatrix Farrand, a distinguished landscape architect, always deliberately mispronounced his name as "Dr. Pax." Karl Sax accepted this graciously and wrote that this was his personality and the role he wished to pursue in his life; but he was never able to do so because of the firmness of his belief in individual integrity.

During his active years at Harvard, Karl Sax supervised the work of five successful candidates for the degree of Master of Arts, and twenty-one for the Doctor of Philosophy in Biology. Numerous postdoctoral scholars worked with him in his laboratories. This is an enviable record of excellent teaching rarely exceeded.

Karl Sax is survived by his widow, Hally Mary Delilia Jolivette Sax, whom he married in 1915 when he was an undergraduate student. Their happy marriage of fifty-eight years produced three sons, Karl Jolivette Sax, William Peter Sax, and Edward A. Sax.

ARNOLD ARBORETUM OF HARVARD UNIVERSITY  
CAMBRIDGE, MASSACHUSETTS 02138

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\* Compiled by Ida Hay Burch, The Arnold Arboretum of Harvard University, Jamaica Plain, Massachusetts 02130.

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